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Gender differentials and old age survival in the Nairobi slums, Kenya

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ABSTRACT

This paper examines gender differentials in survival amongst older people (50+ years) in the Nairobi slums and to the best of our knowledge is the first study of its kind in an urban African setting. The results provide evidence contrary to the expected paradox of poorer self-rated health yet better survival amongst older women. Older women in the Nairobi slums have poorer self-rated health and poorer circumstances across other factors, including disability and socio-economic status. Further, older women in the slums do not have better survival. The conventional female advantage in mortality only becomes apparent after accounting for the cumulative influence of individual characteristics, social networks, health and socio-economic status, suggesting the female advantage in unadjusted old-age mortality does not apply to contexts where women experience significant disadvantage across multiple life domains. This highlights the urgent need to redress the support, status and opportunities available for women across the life course in contexts such as the Nairobi slums. In addition, a greater number of factors differentiate mortality risk amongst men than amongst women, suggesting inequality amongst slum dwelling older men and highlighting the need for gender sensitive interventions which account for the particular needs of both genders in old age.

1. Introduction

Cities in sub-Saharan Africa are increasingly becoming home to older people, typically first generation rural-urban migrants who moved to the cities in the 1970s and 1980s (Chepngeno and Ezeh, 2007). It remains the case that the urban population across sub-Saharan Africa generally includes more men than women (Tacoli, 2012). However, in Kenya the rate of increase in the proportion of older women living in urban areas in recent years has been particularly high. The proportion of women over 50 years living in urban areas increased from 7% in 1989 to 23% in 2009. In comparison, the proportion of older men living in urban areas increased from 12% to 27% in the same period (own analyses of census data, available: United Nations Statistics Division (2014)). Over 60% of the population of Nairobi live in informal settlements and living conditions are amongst the worst in Africa (UN-HABITAT, 2005). Old age is a stage of the life course which poses particular challenges for health and wellbeing in the slums. In the context of minimal formal government support for older people, elders rely on employment opportunities in the informal sector and traditional intergenerational transfers, depending on their health and ability to harness support (Aboderin, 2004).

Research has consistently shown that slum dwellers in general face disproportionate health disadvantages, however very few studies have offered gendered explanations for health inequities within informal settlements (Hawkings et al., 2013). Gender relates both to sex-related biological differences as well as social factors (Prus and Gee, 2003). Focusing on social factors, international commentators have described how cumulative gendered disadvantage in terms of socio-economic position, access to resources and roles and relationships manifest in poorer wellbeing for women later in life (Pratt, 1997; United Nations Economic Commission for Europe, 2009). However, Knodel and Ofstedal (2003) amongst others have highlighted that a blanket assumption of a female disadvantage in social determinants of later life health may be detrimental to supporting older people most in need and advocate the value of contextualised understandings of the role of gender in the ageing experience. This paper explores the intersection between gender and old age health in the Nairobi slums by examining differences in survival amongst older men and women. Old age survival is severely understudied in sub-Saharan Africa; however, research from other settings has consistently highlighted

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gendered patterns of mortality risk. The objectives are (i) to compare mortality risk for older men and women in the Nairobi slums and (ii) to compare gender-specific factors associated with old age mortality risk in this setting.

2. Old age mortality

The majority of studies which have examined the correlates of mortality amongst older people focus on high income settings and have predominately shown strong support networks, high socio-economic status and better health have a protective effect on mortality; and in terms of individual characteristics, women and the younger-old have lower rates of mortality (Idler and Benyamini, 1997; Manzoli, 2007; Rizzuto, 2013).

The female advantage has been linked to biological explanations and differential exposures, and responses to environmental and socio-culturally influenced risk factors amongst men and women (Liang et al., 2003). There are only a limited number of studies focusing on old age mortality in low and middle income settings. However, Barford et al. (2006) note that by the mid-2000s life expectancy at birth was greater for women than men in every country. The female survival advantage has frequently been observed alongside a paradoxical finding that women have poorer self-rated health than men (Oksuzyan et al., 2009). Proposed explanations for this include that women suffer from a greater number of health conditions but that these conditions are less severe than conditions suffered by men (Grundy, 2006) and that the female survival advantage itself extends the length of time women spend in poor health (Luy and Minagwa, 2014). However, several empirical studies from high income settings have shown the female disadvantage in self-rated health is weaker in later life than earlier life stages (Case and Deaton, 2003) or not apparent once other factors are controlled for (Arber and Cooper, 1999).

Experiences of ageing are embedded in the socio-cultural and economic environments in which people live and it is not clear whether findings from high income settings are transferrable to low income contexts. Amongst the sparse literature on old-age mortality in sub-Saharan Africa, a bivariate analysis conducted in Botswana found survival was associated with measures of social networks and lower disability status (Clausen et al., 2007). Based on multivariate analyses, Fantahun et al. (2009) found old age survival in Ethiopia was associated with being female, literate and married, consistent with findings from high income settings. However, when the analyses were stratified by gender, the results showed that literacy status was only significant for men. The authors proposed that this finding may be linked to differences in decision-making between men and women in Ethiopian culture which places men in a stronger position to enjoy the benefits of literacy. This highlights how gendered division of roles and responsibilities influence wellbeing and contribute to accumulative (dis)advantage across the life course.

Studies which have specifically examined the correlates of old age survival in urban slums include Lima-Costa et al.'s (2011) analyses of mortality amongst elders in low income urban Brazil which showed survival was greater amongst women, those who were married, and those with better health and low disability status. Jotheeswaran et al. (2010) conducted analyses of old age survival in urban South India and provided evidence for the protective role of individual characteristics: women and younger older adults had higher odds of survival, and with regards to health status, those with a larger arm circumference, lower disability status and not suffering from dementia had higher odds of survival. The South Indian analyses also considered the role of socio-economic status but did not find a relationship with mortality, which the authors proposed may be linked to selective mortality in earlier life amongst those exposed to the worst economic deprivation. Oti et al. (2011) examined mortality in the Nairobi slums amongst adults aged 15–54 years and found that after controlling for age group and period, mortality risk was higher for women than men. However, when the analyses were stratified by cause of death, it was evident that whilst HIV related mortality risk was higher for women, non-HIV related mortality risk was lower for women. Therefore, it is not clear to what extent selective mortality earlier in adulthood may influence the relationship between gender and mortality in old age in this population. The correlates of mortality specifically amongst older people in the Nairobi slums have not been examined.

3. Gender and old age in the Nairobi slums

There are stark gender differences in livelihood strategies in the informal settlements. Women and girls typically assume responsibility for domestic chores and childcare and enjoy even more limited economic opportunities than male slum dwellers (Hawkings et al., 2013). Women are commonly involved in petty trading or part-time work in the domestic sphere within their community which they juggle alongside childcare, and continue to engage in these livelihood strategies into old age. A greater proportion of older men are employed in the formal sector or in relatively well-paid jobs in the informal sector, which offer better economic returns and stability (Falkingham et al., 2011). However, declining health in later life means older men may no longer be desirable to employers looking to hire workers for physically strenuous jobs. Therefore, older men may struggle more than older women to adapt their livelihood strategies (Mudege and Ezeh, 2009).

Prior analysis of the family ties of older slum dwellers indicate that most older men are married, but that the large majority of older women in the slums are currently unmarried and have typically been previously married or are widows (Ezeh et al., 2006). A greater proportion of older men than older women live alone in the Nairobi slums. However, this is likely to reflect split family strategies whereby migrants reside in the city but their family remains in the origin community: a long-established pattern in African migration which is much more common amongst men (Datta, 1995). Yet older men who live alone but have not retained ties to family in rural areas may be particularly vulnerable if they experience declines in health and their ability to work. A qualitative study focusing on the coping strategies of older people in the Nairobi slums found that older unmarried women may be more readily able to access social support, in part because they have spent their lives working within the slum community, as compared to vulnerable sub-groups of unmarried older men who had largely worked outside the community earlier in their lives and lack strong social and community support (Mudege and Ezeh, 2009).

A prior quantitative study of the health of elders in the Nairobi slums highlighted that women have poorer health outcomes than men (Kyobutungi et al., 2010). In terms of self-rated health, the study found that the proportion of older women reporting poor or very poor health was much higher than the proportion of older men reporting poor or very poor health (22% vs. 9%). Using data from a cohort of older people (60+ years) in an urban low income setting in Brazil, Lima-Costa et al. (2011) reported that the gender difference in poor or very poor was more moderate: 29.3% for women and 19.7% for men. The comparatively high gender differential in the Nairobi slums compared to a Brazilian low income urban setting indicates a particularly large gender inequality in Nairobi. It also stands in contrast to the findings of select studies from high income countries discussed earlier which show modest differences in unadjusted health amongst older men and women

(Arber and Cooper, 1999; Case and Deaton, 2003). This paper seeks to explore gender differentials in later life health in the Nairobi slums further by examining how gender relates to old age mortality in this setting.

4. Data and methods

The study is based on data from a survey on the wellbeing of older people nested within the Nairobi Urban Health and Demographic Surveillance System (NUHDSS). The NUHDSS contains longitudinal data on the population of usual residents of two Nairobi slums: Korogocho and Viwandani, and has been in operation since 2002. Fieldworkers visit each household in the settlements every four months and interview a household member about births, deaths and migrations amongst household members. If it is not possible to interview a household member, a credible neighbour is interviewed. Information from neighbours on the occurrence of deaths is likely to have a similar level of accuracy as data from household members, given the high population densities in the slums and the high frequency of visits from fieldworkers who repeatedly ask about demographic events, However, there may be a higher degree of inaccuracy in information on exact date of death from neighbours as opposed to household members. Small inaccuracies in date of death information are unlikely to significantly affect the results of this paper. Data collection for the older people's survey was conducted between 2006 and 2007 and the eligibility list included all residents aged 50 years or older (n = 2972). This threshold for old age is younger than standard international definitions. However, the physical impairments associated with old age start manifesting at relatively younger ages in the slums (Mudege and Ezeh, 2009). The response rate was 88% (n = 2608). It was not possible to link survey and NUHDSS data for 102 survey participants (4%) so they were excluded from the analysis, an additional 64 individuals (2%) were excluded because data were missing for one or more of the variables in the survey data and 25 individuals (<1%) were excluded due to attrition in the follow-up period to 2012. Therefore, the sample used included 2417 individuals. No statistically significant associations were found between the baseline characteristics and whether or not an individual was lost to follow up. Data collection was conducted under the auspices of the African Population and Health Research Center. Ethical approval was granted by the Kenya Medical Research Institute (KEMRI/RES/7/3/1).

The survival variable was constructed by using the longitudinal data on the dates of deaths or out-migrations amongst the sample collected in the NUHDSS between baseline (2006/07) and the end of the follow-up period (31st December 2012). Table 1 shows the distribution of the sample by gender and whether they died, out-migrated or remained living in the slums during this period. Four clusters of independent variables were considered in the analysis: individual characteristics, social networks, socio-economic status and health status. The individual characteristics variables were age, gender, ethnicity, length of stay in the slums and slum of residence.

Table 1
Distribution of the sample of older Nairobi slum dwellers by whether they remained in the DSS, died or out-migrated during the period 2006/07–2012.

	Men		Women		Total	
	N	%	N	%	N	%
Remained in the DSS	866	54%	503	61%	1369	57%
Died	149	9%	100	12%	249	10%
Out-migrated	573	36%	226	27%	799	33%
Total	1588	100%	829	100%	2417	100%

The social network variables were marital status and location of spouse, household type (single or multi-person), proximity of children, number of friends, frequency of meetings with community leaders and frequency of attendance at religious ceremonies. Two health measures were used. Firstly, self-rated health rated on a five point Likert scale. Very few participants answered in the top or bottom category therefore the scale was collapsed into a three category variable. Secondly, disability status, based on self-reported functional status, was assessed using the standardised 12-item WHO Disability Assessment Scale. This measure is based on responses to questions on physical functioning including activities of daily life and instrumental activities of daily life. The measure is categorised according to scores representative of no, mild, moderate, severe and extreme disability (World Health Organisation, 2001). The categories 'severe' and 'extreme' were collapsed as only 3 individuals were in the extreme category. A quintile variable using household assets data was derived to create a household level measure of socio-economic status. Variables for livelihood strategy and highest education level were also used to represent socio-economic status.

Cross-tabulations of the individual characteristics, social networks, health and socio-economic status of older men and women were used to describe the sample at baseline and to explore gender differences in older people's circumstances. Non-response weights based on age, sex and slum site were applied. As the data were weighted, the Rao and Scott (1987) second order correction to the Pearson chi-squared statistic was used to test for difference.

The crude mortality rate for older people in the slums was constructed by calculating the number of observed deaths per 1000 person-years lived. This was compared to the crude mortality rate for all older people in Kenya calculated using 2009 census data. To account for differences in the age structure of the slum older population and the national older population, the age-adjusted mortality rate for older people in the slums was also calculated using the national age structure. The age-adjusted mortality rate for older people in the slums was calculated with and without those who out-migrated to assess the impact of including migrants in the analysis. In addition, Cox proportional hazard models were used to examine the relationships between propensity to out-migrate and the age and health status variables for individuals who remained living in the slums. This made it possible to assess whether out-migrants were likely to have high mortality rates after leaving the slums as age and health status are described as strong predictors of mortality in the literature. The response outcome for these models was whether an older person living in the slum out-migrated during the observation period. The variable used to denote time was duration of follow-up in days until out-migration or end of follow-up (for more information on the method, see Cox (1972)). A key assumption of the Cox model is that the hazard of the outcome for different levels of covariates remains proportional over time. It is not possible to test this assumption when models are weighted; therefore, weights were not used for the multivariate analysis. The results of tests for the proportional hazards assumptions are presented at the bottom of each table include Cox model(s). All the p-values for these tests were greater than 0.05, indicating the assumption was not been violated.

Kaplan-Meier survival curves and a log-rank test were used to assess differences in mortality by gender. Cox-proportional hazard models were also used to model the effects of individual characteristics, social networks, health status and socio-economic status on the hazard of mortality. Individuals who out-migrated were included in the analysis whilst they were living in the slums. These individuals were censored from the day they out-migrated. The response outcome is whether an older person living in the slum died during the observation period. The variable used to denote

time is the duration of follow-up in days until out-migration or end of follow-up. The analyses were conducted in Stata version 14.

5. Results

5.1. Characteristics of older men and women

Table 2 compares the characteristics of older men and women at baseline. Over half of older women belong to the Kikuyu ethnic group. Kikuyu communities are largely concentrated in the central province surrounding Nairobi. Therefore, older female slum dwellers are likely to have moved into the settlements from nearby. In comparison, the ethnic composition of older men is more varied and includes a greater share of other ethnic groups whose populations are largely concentrated in other areas. This suggests many older men are likely to have in-migrated from further afield. Older men have a younger age distribution and on average have spent a shorter period of time living in the slums than older women. Older men report attending religious ceremonies less often than older women. However, men report more close friends and meet with community leaders more frequently than women, indicative of gender differences in social networks. Results presented in Table 2 also confirm that older men have significantly better self-rated health and disability status and a stronger socio-economic position than older women.

5.2. Mortality rate

Table 3 includes mortality rates for older people in the slums and the national crude mortality rate for older people in Kenya. The crude mortality rate for older people in the slums is 22.8 deaths per 1000 person-years. This is significantly lower than the national crude mortality rate for older Kenyans which is 40.9 deaths per 1000 person-years. However, the age distribution of the older slum population is younger than the national older population. The old-age mortality rate in the slums standardised by the national age structure is 34.6 deaths per 1000 person-years. This age-standardised rate is closer to the national estimate than the crude rate estimate for the slums, but remains lower than the national estimate. The age-standardised mortality rate for individuals who died or remained living in the slums throughout the follow-up period only (hence not including the out-migrants) is 41.6 deaths per 1000 person-years, slightly higher than the national estimate.

Table 4 presents models on propensity to out-migrate amongst all older people who remain living in the slums by age and health status for all older people (model 1) and for older men (model 2) and older women (model 3) separately. It is evident that age is not significantly associated with out-migration in the combined model or for either gender separately, and poorer self-rated health is only associated with an increased propensity to out-migrate amongst women. There is a non-linear relationship between disability status and out-migration: older men and women with severe or extreme disability have the highest propensity to out-migrate, yet older people with moderate disability have the lowest propensity to out-migrate. Collectively these results indicate that there are relatively weak associations between the key predictors of old age mortality (age and health status) and out-migration. This may help explain why the difference between the age-adjusted mortality rate including migrants (34.6 deaths/1000 person years) and the age-adjusted mortality rate excluding migrants (41.6 deaths/1000 person years) is modest. The true age-adjusted mortality rate for older people living in the slums at baseline is likely to be somewhere between these two estimates. Given the harsh living conditions, even these adjusted rates indicate that old age mortality in the slums is surprisingly low.

5.3. Mortality-gender relationship

Fig. 1 displays survival curves by gender. Female survival is slightly lower than male survival, although a log-rank test confirms that the difference is insignificant ($p = 0.1040$). This is contrary to the expected finding of a female advantage. Table 5 displays a series of multivariate models for factors associated with survival for older men and women combined. Model 1 includes individual characteristics only. It is evident that advanced age is strongly correlated with decreased survival and certain ethnic groups experience lower odds of survival, but slum site and duration of residence in the slums are not significantly related to survival. The hazard of mortality for women is 7% lower than for men after accounting for these factors but gender remains an insignificant predictor of survival.

Model 2 includes variables representing individual characteristics and social networks. It is evident that after adjusting for social networks and individual characteristics, women experience a 27% reduction in hazard of mortality relative to men and this result is statistically significant at the 10% level ($p = 0.088$). Model 3 includes individual characteristics and health status and shows that both self-rated health and disability status are highly associated with mortality risk: older people in good health and without a high level of disability experience a much lower mortality risk than those in ill health. Controlling for these variables also leads to a significant gender differential at the 10% level ($p = 0.068$). Model 4 includes individual characteristics and socio-economic status and indicates that after controlling for socio-economic status gender becomes a significant protective factor at the 10% level ($p = 0.093$).

The final model, model 5, includes all four variable groups and shows that after controlling for the cumulative influence of individual characteristics, social networks, health status and socio-economic status a clear gender differential emerges. Women have a mortality risk which is 41% lower than mortality risk for men, a result which is statistically significant at the 1% level ($p = 0.006$). This finding indicates that the female advantage in mortality only becomes apparent when comparing older men and women in similar positions. The severely disadvantaged status of women in comparison to men highlighted in the descriptive analysis (Table 2), means this advantage is not visible when comparing unadjusted mortality for older men and women.

5.4. Multivariate analyses of factors associated with mortality by gender

Table 6 presents parsimonious multivariate models for factors which are independently associated with the hazard of mortality for older men (model 1) and for older women (model 2). It is evident that having lived in the slums for a longer period is a significant protective factor for mortality amongst older women. This is despite the fact that models presented in Table 5 indicate that duration of residence in the slums is not statistically significantly related to mortality risk for older men and women combined. It may be that women who move to the slums later in life have weaker social networks and have experienced greater adversity or a significant upheaval in their lives which triggered their in-migration, circumstances which are contributing to their higher risk of mortality. However, none of the measures of social networks or socio-economic status are significantly related to mortality risk for women after controlling for other factors. Interaction terms were also tested between duration of residence in the slums and each of these measures but none of these factors significantly influenced the relationship between duration of residence in the slums and hazard of mortality amongst women. Analysis of data on main reason for moving to the slums indicates that women who arrived in the previous ten years are significantly less likely to have

Table 2
Characteristics of older men and women in the Nairobi slums, 2006/07.

	Men		Women		Total		p-value[b]
	N	%[a]	N	%[a]	N	%[a]	
Individual characteristics							
Age (years)							<0.0001
50–59	1167	74%	485	59%	1652	69%	
60–69	290	18%	200	23%	490	19%	
70+	131	8%	144	18%	275	11%	
Ethnicity							<0.0001
Luo	301	20%	108	13%	409	18%	
Kikuyu	576	35%	475	57%	1051	42%	
Kamba	252	16%	51	6%	303	13%	
Luhya	224	14%	57	7%	281	11%	
Other	235	15%	138	17%	373	16%	
Duration of residence in the slums (years)							<0.0001
20+	713	43%	497	58%	1210	48%	
10–19	451	29%	167	22%	618	27%	
<10	424	28%	165	20%	589	25%	
Slum							<0.0001
Korogocho	1003	60%	650	75%	1653	65%	
Viwandani	585	40%	179	25%	764	35%	
Social networks							
Marital status							<0.0001
Not currently married	157	10%	566	68%	723	28%	
Spouse lives elsewhere	732	47%	47	6%	779	34%	
Co-resident spouse	699	43%	216	26%	915	38%	
Household type							<0.0001
Single person	641	41%	214	26%	855	36%	
Multi-person	947	59%	615	74%	1562	64%	
Location of children							<0.0001
No surviving children	92	7%	60	8%	152	7%	
All children live outside Nairobi	273	17%	76	10%	349	15%	
Some children live in Nairobi & some outside Nairobi	793	50%	378	45%	1171	48%	
All children live in Nairobi	430	26%	315	37%	745	30%	
Number of friends							0.0101
0	62	4%	49	6%	111	5%	
1–2	652	40%	351	42%	1003	41%	
3–4	409	26%	221	27%	630	26%	
4+	465	30%	208	25%	673	29%	
Frequency of meetings with a community leader							0.0001
Never	929	58%	545	67%	1474	61%	
Less than once a week	420	27%	159	19%	579	24%	
Once or more a week	238	15%	125	14%	363	15%	
Frequency of attending religious ceremonies							
Never	55	4%	29	4%	84	4%	
Less than once a year	125	8%	48	6%	173	7%	
Once or twice a month	216	15%	47	6%	263	12%	
Once a week	873	58%	517	64%	1390	60%	
More than once a week	233	15%	166	21%	399	17%	
Self-rated health							<0.0001
Poor or very poor	144	9%	186	23%	330	13%	
Moderate	397	25%	289	36%	686	29%	
Good or very good	1047	66%	354	42%	1401	58%	
Disability status							<0.0001
Severe/extreme disability	64	4%	110	14%	174	7%	
Moderate disability	366	23%	294	35%	660	26%	
Mild disability	703	45%	312	38%	1015	43%	
No problems	455	28%	113	13%	568	24%	
Socio-economic status							
Livelihood strategy							<0.0001
Other or unemployed	70	4%	181	21%	251	9%	
Runs own business	554	34%	514	63%	1068	43%	
Informal employment	571	36%	96	12%	667	29%	
Formal employment	393	25%	38	5%	431	19%	
Household assets quintile							<0.0001
1 (poorest)	225	14%	168	20%	393	16%	
2	253	16%	110	13%	363	15%	
3	192	12%	123	14%	315	13%	
4	201	12%	138	17%	339	14%	
5 (wealthiest)	230	14%	138	16%	368	15%	
Missing	487	32%	152	19%	639	28%	
Highest level of education							<0.0001
None	248	15%	332	40%	580	23%	
Primary	952	60%	368	45%	1320	55%	
Secondary	334	22%	52	6%	386	17%	

(*continued on next page*)

Table 2 (*continued*)

	Men		Women		Total		p-value[b]
	N	%[a]	N	%[a]	N	%[a]	
Missing	54	4%	77	9%	131	5%	
Total	1588	100%	829	100%	2417	100%	
Row percentage	68%		32%		100%		

[a] Weighted percentages.
[b] Test result for the Rao and Scott (1987) second order correction to the Pearson chi-squared statistic.

Table 3
Mortality rates for older people in the Nairobi slums, 2006/07–2012.

	Deaths per 1000 people aged 50+ years
Crude mortality rate for the Nairobi slums	22.8
Age-adjusted mortality rate for the Nairobi slums	34.6
Age-adjusted mortality rate for the Nairobi slums excluding out-migrants	41.6
National crude mortality rate	40.9

Source: Nairobi Urban Health and Demographic Surveillance System and 2009 census data (available: World Health Organisation (2013)).

Table 4
Cox proportional hazard models for factors associated with out-migration amongst individuals who survive in the slums for older men and women combined, older men only and older women only in the Nairobi slums, 2006/07–2012.

	Model 1: Both genders (N = 2168)			Model 2: Men only (N = 1439)			Model 3: Women only (N = 729)		
	H.R.	S.E.	p-value	H.R	S.E.	p-value	H.R.	S.E.	P-value
Age (years)	1.00	<0.01	0.819	1.00	0.01	0.628	1.00	0.01	0.917
Self-rated health									
(Poor or very poor)									
Moderate	0.87	0.11	0.264	1.02	0.18	0.918	0.70	0.13	0.053
Good or very good	0.88	0.11	0.304	1.00	0.17	0.993	0.65	0.13	0.027
Disability status									
(Severe/extreme disability)									
Moderate disability	0.65	0.10	0.006	0.59	0.14	0.023	0.68	0.15	0.078
Mild disability	0.80	0.13	0.160	0.70	0.16	0.116	0.87	0.20	0.537
No problems	0.86	0.15	0.383	0.74	0.18	0.215	0.85	0.24	0.563
Proportional hazards assumption p-value	0.373			0.345			0.123		

'H.R.': hazard ratio. 'S.E.': standard error.

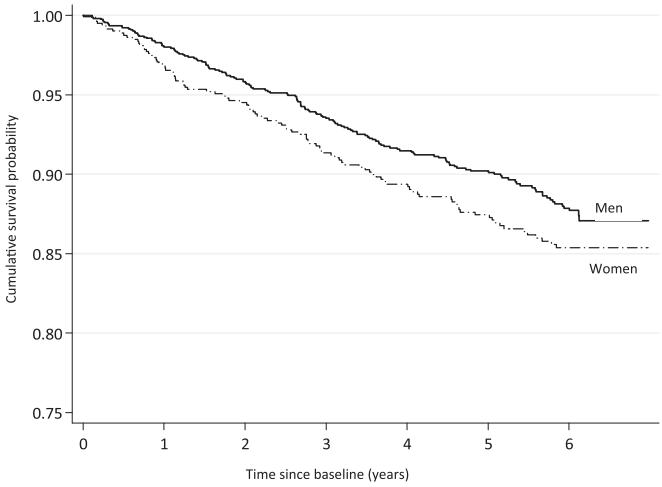

Fig. 1. Kaplan-Meier survival curves for older men and women in the Nairobi slums, 2006/07–2012.

moved with family than women who arrived earlier (9% vs. 19%), but are more likely to have moved to join family (16% vs. 6%). This suggests women who move to slums in later life may be in need of support. Age and disability status are the only other variables which are independently associated with the hazard of female mortality.

Good or very good self-rated health, residing in a wealthier household and frequent attendance at religious ceremonies each have an independent significant protective effect on mortality amongst older men, in addition to belonging to a younger age group and certain ethnic groups. Significant differences by ethnicity were also not detected amongst older women, a finding which is likely to relate to the fact that there is greater ethnic diversity amongst men (Table 2). There is more variation in attendance at religious ceremonies amongst older men: only 16% of older women do not attend religious ceremonies at least once a week compared to 27% of older men, which may help explain why frequent attendance at religious ceremonies differentiates mortality risk amongst men but not women. Overall, a greater number of factors differentiate mortality risk amongst men as compared to women, which may indicate that there is greater within-gender inequality in circumstances of older men. This finding may also be linked to the fact there are more men than women in the sample, thus greater statistical power to test for difference.

Self-rated health and disability status are both significant in the full model for mortality among men and women together (model 5, Table 5). However, it is evident that only better self-rated health remained a significant protective factor in the male-only parsimonious model and only lower disability status remained a significant protective factor in the female-only parsimonious model (Table 6).

Table 5
Cox proportional hazard models for factors associated with mortality for older men and women combined in the Nairobi slums, 2006/07–2012.

	Model 1			Model 2			Model 3			Model 4			Model 5		
	Individual characteristics (n = 2417)			Individual characteristics & social networks (n = 2417)			Individual characteristics & health (n = 2417)			Individual characteristics & socio-economic status (n = 2417)			Individual characteristics, social networks, health and socio-economic status (n = 2417)		
	H.R.	S.E.	p-value	H.R.	S.E.	p-value	H.R.	S.E.	p-value	H.R.	S.E.	p-value	H.R.	S.E.	p-value
Individual characteristics															
Gender															
(Male)															
Female	0.93	0.13	0.614	0.73	0.13	0.088	0.77	0.11	0.068	0.77	0.12	0.093	0.59	0.11	0.006
Age (years)	1.06	0.01	<0.001	1.05	0.01	<0.001	1.05	0.01	<0.001	1.05	0.06	<0.001	1.04	0.01	<0.001
Ethnicity															
Luo															
Kikuyu	0.85	0.19	0.466	0.79	0.18	0.296	0.87	0.20	0.543	0.81	0.18	0.347	0.79	0.18	0.313
Kamba	0.70	0.19	0.193	0.62	0.18	0.091	0.69	0.19	0.173	0.68	0.18	0.151	0.57	0.17	0.055
Luhya	0.48	0.16	0.024	0.47	0.15	0.018	0.49	0.16	0.028	0.48	0.16	0.025	0.48	0.16	0.023
Other	0.78	0.20	0.317	0.83	0.22	0.492	0.72	0.18	0.193	0.73	0.19	0.238	0.73	0.21	0.263
Duration of residence in the slums (years)															
(<10)															
10–19	0.78	0.15	0.203	0.79	0.16	0.246	0.79	0.16	0.240	0.83	0.17	0.367	0.83	0.17	0.363
20+	0.77	0.14	0.141	0.79	0.15	0.199	0.77	0.14	0.151	0.80	0.15	0.216	0.76	0.15	0.152
Slum															
(Korogocho)															
Viwandani	0.95	0.16	0.759	0.86	0.16	0.406	0.99	0.17	0.943	1.00	0.18	0.989	0.96	0.18	0.83
Social networks															
Marital status															
(Not currently married)															
Spouse lives elsewhere				0.66	0.14	0.045							0.89	0.19	0.593
Co-resident spouse				0.59	0.14	0.021							0.74	0.17	0.190
Household type															
(Single person)				0.91	0.15	0.583							0.89	0.15	0.501
Multi-person															
Location of children															
(No surviving children)				0.62	0.19	0.109							0.66	0.20	0.179
All children live outside Nairobi				0.69	0.17	0.134							0.84	0.22	0.490
Some children live in Nairobi & some outside Nairobi				0.62	0.16	0.365							0.91	0.74	0.278
All children live in Nairobi															
Number of friends															
(0)															
1–2				0.74	0.19	0.258							0.85	0.23	0.560
3–4				0.68	0.17	0.174							0.81	0.24	0.481
4+				0.71	0.16	0.236							0.91	0.26	0.758
Frequency of meetings with a community leader															
(Never)															
Less than once a week				1.10	0.24	0.672							1.08	0.23	0.725
Once or more a week				0.94	0.18	0.763							0.87	0.17	0.476
Frequency of attending religious ceremonies															
(Never)															
Less than once a year				0.93	0.31	0.823							0.82	0.28	0.566
Once or twice a month				1.10	0.36	0.771							1.11	0.37	0.745
Once a week				0.62	0.18	0.097							0.61	0.18	0.097
More than once a week				0.50	0.16	0.030							0.45	0.15	0.015
Health															
Self-rated health															
(Poor or very poor)															
Moderate							0.60	0.11	0.005				0.57	0.11	0.004
Good or very good							0.55	0.10	0.002				0.51	0.10	0.001
Disability status															
(Severe/extreme disability)															
Moderate disability							0.53	0.11	0.001				0.58	0.12	0.009
Mild disability							0.50	0.11	0.001				0.60	0.14	0.027
No problems							0.41	0.11	0.001				0.46	0.13	0.006
Socio-economic status															
Livelihood strategy															
(Other or unemployed)															
Runs own business										0.96	0.18	0.813	1.02	0.20	0.920
Informal employment										0.70	0.16	0.124	0.72	0.17	0.171
Formal employment										0.60	0.17	0.069	0.65	0.19	0.144
Highest level of education															
(None)															
Primary										0.97	0.16	0.876	0.90	0.16	0.546

(*continued on next page*)

Table 5 (*continued*)

	Model 1			Model 2			Model 3			Model 4			Model 5		
	Individual characteristics (n = 2417)			Individual characteristics & social networks (n = 2417)			Individual characteristics & health (n = 2417)			Individual characteristics & socio-economic status (n = 2417)			Individual characteristics, social networks, health and socio-economic status (n = 2417)		
	H.R.	S.E.	p-value	H.R.	S.E.	p-value	H.R.	S.E.	p-value	H.R.	S.E.	p-value	H.R.	S.E.	p-value
Secondary										0.72	0.20	0.238	0.69	0.20	0.190
Missing										0.91	0.26	0.747	0.73	0.23	0.324
Household assets quintile (1 (poorest))															
2										0.59	0.12	0.013	0.61	0.13	0.026
3										0.67	0.14	0.061	0.63	0.14	0.038
4										0.60	0.13	0.020	0.57	0.13	0.016
5 (wealthiest)										0.40	0.10	<0.001	0.38	0.38	<0.001
Missing										0.73	0.14	0.115	0.69	0.14	0.068
Proportional hazard assumption p-value	0.537			0.253			0.833			0.754			0.640		

'H.R.': hazard ratio. 'S.E.': standard error.

Table 6
Parsimonious cox proportional hazard models for factors associated with mortality for older men and women in the Nairobi slums, 2006/07–2012.

	Model 1: Men (n = 1588)			Model 2: Women (n = 829)		
	Hazard ratio	S.E.	p-value	Hazard ratio	S.E.	p-value
Individual characteristics						
Age (years)	1.05	0.01	<0.001	1.05	0.01	<0.001
Ethnicity (Luo)						
Kikuyu	0.76	0.19	0.267			
Kamba	0.41	0.13	0.005			
Luyha	0.33	0.12	0.003			
Other	0.59	0.19	0.099			
Length of stay (years) (<10)						
10–19				0.91	0.25	0.487
20+				0.53	0.13	0.011
Social networks						
Frequency of attendance at religious ceremonies (Never)						
Less than once a year	0.85	0.36	0.703			
Once or twice a month	0.90	0.36	0.790			
Once a week	0.47	0.17	0.038			
More than once a week	0.45	0.18	0.058			
Health & wellbeing						
Self-rated health (Bad or very bad)						
Moderate	0.50	0.12	0.005			
Good or very good	0.33	0.08	<0.001			
Disability status (Severe or extreme disability)						
Moderate disability				0.39	0.10	<0.001
Mild disability				0.33	0.10	<0.001
No disability				0.20	0.10	0.001
Socio-economic status						
Household assets kept in the slums quintile (1 (poorest))						
2	0.81	0.21	0.432			
3	0.86	0.25	0.595			
4	0.47	0.17	0.036			
5 (wealthiest)	0.39	0.13	0.006			
Missing	0.69	0.17	0.142			
Test of proportional hazards p-value	0.096			0.655		

'S.E.': standard error.

6. Discussion

This paper contributes to the sparse literature on ageing, gender and health in sub-Saharan Africa, and to the best of our knowledge is the first to focus on old age mortality in slum areas, where the majority of the region's urban population reside (UN-HABITAT, 2003). Contrary to the expected paradox of poorer self-rated health yet better survival amongst older women, we find evidence of much poorer self-rated health (and poorer circumstances across numerous other factors) but no evidence of better survival

amongst older women. The female advantage only becomes apparent when controlling for the cumulative influence of individual characteristics, social networks, health status and socio-economic status, and thus comparing older men and women in similar circumstances. This finding suggests the female survival advantage in unadjusted old age mortality may not apply to contexts where women experience significant disadvantages across multiple domains of their lives. This is an especially striking result given that we show older women who report poor or very poor health are significantly more likely to out-migrate (whilst self-reported health is not associated with male out-migration). Furthermore, previous research using this dataset has shown that older women with shorter duration of residence, a factor we find to be a significant predictor of female mortality, also have a higher propensity to out-migrate (Falkingham et al., 2012). Hence if out-migration was reducing the level of old age mortality observed in the slums, estimates for older women would be expected to be particularly reduced thus making our results all the more remarkable.

The gender specific models highlight a greater number of factors differentiate mortality risk amongst men than amongst women, suggesting there is greater within-gender inequality amongst older men. This is supported by the findings of a qualitative study in the Nairobi slums which highlighted the existence of vulnerable sub-groups of older men (Mudege and Ezeh, 2009), as well as broader international literature on the need to develop contextualised understandings of the vulnerabilities of both older men and women (Knodel and Ofstedal, 2003). An important limitation of the analyses of protective factors for old age mortality amongst men and women was the fact that covariates were measured at baseline only. It would have been insightful to explore how trajectories in social networks, health status and socio-economic status relate to mortality risk. This would have furthered understanding of how older men and women navigate the challenges and shocks associated with living in the slums. Based on the gender specific models, priorities for supporting older men in the Nairobi slums should include harbouring the benefits of regular attendance at religious ceremonies, targeting those in the poorest households and investigating the root causes of health inequalities by ethnicity. Providing assistance to recent female in-migrants is valuable for supporting the resilience of older women in this setting.

The gender specific models of old age survival also indicate that self-rated health is a significant independent predictor of mortality amongst older men, whilst the WHO disability measure is a significant independent predictor amongst older women. The WHO disability measure was developed to provide a robust measure of disability using self-reports. The findings of this study suggest this is a stronger predictor of mortality than self-rated health amongst women. This is supported by Hirve et al.'s (2012) finding that self-rated health was not a significant predictor of old age female mortality in rural India once the WHO disability measure was accounted for, and a body of prior work on mortality and self-rated health which show the relationship is weaker for women compared to men (Li and Liu, 2008; Spiers et al., 2003).

The crude mortality rate for older people in the Nairobi slums is surprisingly low, suggesting men and women who made the decision to move to the slums earlier in adulthood and then did not succumb to the health risks of slum life survive longer than expected in later life, possibly linked to a 'healthy migrant effect'. Whilst women of reproductive age have been disproportionally affected by the HIV epidemic, men have higher non-HIV related mortality (Oti et al., 2011). Therefore, selective survival is likely to be apparent amongst both genders in this cohort of older people.

Approximately one third of the cohort analysed in this paper out-migrated over the follow-up period and their subsequent survival status is unknown. Migration may enable older people to access familial support and affordable housing, yet on the other hand elders may struggle with the economic costs of the move and re-integration into the community (Chepngeno and Ezeh, 2007). In their study of old-age mortality in Ethiopia, Fantahun et al. (2009) observed both higher in-migration and mortality for rural areas compared to urban areas. Previous work using the same dataset has shown older men in this population are more likely to out-migrate if they have poorer socio-economic status (measured by employment status) and social networks (measured by involvement in community affairs) (Falkingham et al., 2012). Whilst these factors were not significant in the parsimonious models for mortality amongst men, related variables (household asset ownership and attendance at religious ceremonies) were found to be significantly related to mortality risk. For women, poorer self-rated health is associated with out-migration and a key determinant of mortality in the slums. Duration of residence in the slums has also been linked to propensity to out-migrate in previous research using the same dataset (Falkingham et al., 2012), hence the likelihood that female out-migrants have higher subsequent mortality is stronger. However, it may also be that older men and women in these circumstances who out-migrate fare better in their destination than peers in similar circumstances who remain in the slums.

7. Conclusion

The key contribution of this paper is to show the female advantage in survival is not detectable when comparing unadjusted survival amongst older men and women in the Nairobi slums, and only becomes apparent when comparing older men and women in similar circumstances. This finding provides evidence for the continued need to tackle female disadvantages across the life course in informal settlements and is particularly pertinent given the increasing number of older women living in urban Kenya. In addition, the paper shows that a greater number of factors differentiate mortality risk amongst older men than amongst older women, indicative of the existence of comparatively vulnerable male sub-groups and highlighting the need for gender sensitive policies which meet the needs of both genders in old age.

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